

Application No.:
Amendment Dated:
Reply to Office Action of:

09/676,680
March 8, 2004
December 8, 2003

MAT-8021US

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Currently Amended) An image recognizing method comprising the steps of:

- (a) dividing an input image into a plurality of local-segments;
- (b) registering a learning image into a learning image database;
- (c) selecting a local-segment from the plurality of local-segments;
- (d) extracting a learning-local-segment from the learning image database which is similar to one of the selected local-segments from the learning image database;
- (e) relating the extracted learning-local segment extracted in the step (c) to the one of the selected local-segments;
- (f) estimating a position of an object to be identified in the input image from coordinates of the one of the selected local-segments and coordinates of the related learning-local-segment;
- (g) repeating steps (c), (d), (e), and (f) for each local-segment of the plurality of local-segments;
- (h) counting a-pairs formed of one of the local-segments and the related learning-local-segment from which having an estimated position for the object substantially equal to a first position is estimated to determine a score for the first position; and
- (i) judging that the object to be identified is present at the first position when the determined score is greater than a predetermined number.

a3

2. (Currently Amended) An image recognizing method comprising the steps of:

- (a) dividing an input image into a plurality of local-segments;
- (b) dividing a learning image into a set of learning-local-segments having a same size as the local-segments and making a group of some subsets, each subset formed of the learning-local-segments, from the set of learning-local-segments, which are similar to each other;
- (c) for each of the subsets of learning-local-segments, registering image data of a representative learning-local-segment ~~of the group~~ and coordinates of all the ~~some~~ of the learning-local-segments of the corresponding subset into a same-type window database;
- (d) selecting a local-segment from the plurality of local-segments;
- (e) extracting a representative learning-local-segment from the same-type window database which is similar to the selected one of the local-segments from the same-type window database;
- (f) relating the one of the selected local-segments segment to a group one subset of the subsets of learning-local-segments which includes the extracted representative learning-local-segment extracted in the step (d);
- (g) estimating a position of an object to be identified in the input image from coordinates of the one of the selected local-segment and coordinates of the related representative learning-local-segment of the group;
- (h) repeating steps (d), (e), (f), and (g) for each local-segment of the plurality of local-segments;
- (i) counting a pairs formed of one of the local segments and a related representative learning-local-segment having an estimated position for the object substantially equal to from which a first position is estimated to determine a score for the first position; and

(hj) judging that the object to be identified is present at the first position when the determined score is greater than a predetermined number.

3. (Currently Amended) The image recognizing method according to claim 1, wherein:

said step (b) comprises the step of registering the learning image into the learning image database by a characteristic of an-the object to be identified;

said step (ed) comprises the step of extracting the learning-local-segment which is similar to the one-of-the selected local-segment from the learning image database by the characteristic; and

a³
said step (fh) comprises the step of counting a-pairs formed of one of the local-segments and a-the related learning-local-segment by the characteristic.

4. (Currently Amended) The image recognizing method according to claim 2, wherein said step (c) comprises the step of, for each subset of learning-local-segments, registering image data of the representative learning-local-segment of the group and coordinates of all the-some of the learning-local-segments in-of the group corresponding subset and a characteristic of an-the object to be identified into the same-type window database.

5. (Currently Amended) The image recognizing method according to claim 1, wherein-wherein:

the step (d) comprises-includes the steps of:;

(d-1) calculating a sum of one of (i) each square of a difference between a pixel value of the one-of-the selected local-segment and a pixel value of the-one of the learning-local-segments and (ii) each absolute value of the difference-between the pixel value of the selected local-segment and the pixel value of the one of the learning-local-segments for each learning-local-segment; and, and

(d-2) extracting a pair formed of one of the selected local-segments segment and a learning-local-segment for which has the sum is minimizedum one of the sum; and

step (e) includes the step of (d-2) relating the one of the selected local-segment to the learning-local-segment in the pair extracted in said step (d-12).

6. (Currently Amended) The image recognizing method according to claim 2, wherein said:

step (e) comprises includes the steps of:

a³
(e-1) calculating a sum of one of (i) each square of a difference between a pixel value of the selected one of the local-segment and a pixel value of one of the representative learning-local-segments and (ii) each absolute value of the difference between the pixel value of the selected local-segment and the pixel value of the one of the representative learning-local-segments for each learning-local-segment; and, and

(e-2) extracting a pair formed of one of the selected local-segment and a representative learning-local-segment for which the sum is has minimum minimizedone of the sum; and

step (f) includes the step of (e-2) relating the one of the selected local-segment to the representative learning-local-segment in the pair extracted in said step (e-12).

7. (Currently Amended) An image recognizing apparatus comprising:

image dividing means for dividing an input image into a plurality of local-segments;

learning means for registering a learning image into a learning image database;

similar window extracting means for selecting a local-segment from the plurality of local-segments, for extracting a learning-local-segment from the learning image database which is similar to one of the selected local-segments from the learning image database and for relating the extracted learning-local-segment to the one of selected the local-segment;

object position estimating means for estimating a position of an object to be identified in the input image from coordinates of the selected one of the local-segment and coordinates of the related learning-local-segment;

a3
counting means for counting a-pairs formed of one of the local-segments and a the related learning-local-segment having an estimated position for the object substantially equal to from which a first position is estimated by said object position estimating means to determine a score for the first position to determine a score for the first position; and

object determining means for judging that the object to be identified is present in-at the first position when the determined score is greater than a predetermined number.

8. (Currently Amended) An image recognizing apparatus comprising:

image dividing means for dividing an input image into a plurality of local-segments;

learning means for dividing a learning image into a set of learning-local-segments having a same size as the local-segments and for making a-subsets, each subset formed group of some of the learning-local-segments, from the set of learning-local-segments, which are similar to each other and for each subset of learning-local-segments, registering a representative learning-local-segment of the group and coordinates of all the some of the learning-local segments of the corresponding subset into a same-type window database;

similar window extracting means for selecting a local-segment from the plurality of local-segments, for extracting from the same-type window database the-a

representative learning-local-segment of the group one subset of the subsets which is similar to one of the selected local-segments segment of the input image, and for relating the extracted representative learning-local-segments segment to the one of the selected local-segment;

object position estimating means for estimating a position of an object to be identified in the input image from coordinates of the selected one of the local-segment and coordinates of the related representative learning-local-segment;

a³
counting means for counting a-pairs formed of one of the local-segments and the related representative a-learning-local-segments segment having an estimated position for the object substantially equal to from which a first position is estimated by said object position estimating means to determine a score for the first position; and

object determining means for judging that the object to be identified is present at the first position when the determined score is greater than a predetermined number.

9. (Currently Amended) An image recognizing apparatus comprising:

image dividing means for dividing an input image into a plurality of local-segments;

learning means for registering learning images by a characteristic of an object to be identified into a learning image database;

similar window extracting means for selecting a local-segment from the plurality of local-segments, for extracting a learning-local-segment from the learning image database by the characteristic which is similar to one of the selected local-segments segment, from the learning image database by the character and for relating the extracted learning-local-segment to the one of the selected local-segment by the characteristic;

object position estimating means for estimating a position of an object to be identified in the input image from coordinates of the one of the selected local-segment and coordinates of the related learning-local-segment— by the characteristic;

counting means for counting a-pairs formed of one of the local-segments and a the related learning-local-segment having an estimated position for the object substantially equal to from which a first position is estimated by said object position estimating means to determine a score for the first position by the characteristic; and

object determining means for judging that the object to be identified is present at the first position when the determined score is greater than a predetermined number.

10. (Currently Amended) The image recognizing apparatus according to claim 8, wherein said learning means includes:

a 3
similar window integrating means for making a group of some of the subsets of learning-local-segments which are similar to each other stored in the learning image database and for releasing image data of a-the representative learning-local-segment of the group each subset and the coordinates of all the some of the learning-local-segments in the group each subset; and

a same-type window database for storing the image data of the representative learning-local-segment of the group each subset and the coordinates of all the some of the learning-local-segments in the group each subset.

11. (Currently Amended) A computer-readable storage medium holding a program for making a computer carry out an image recognizing method, said image recognizing method comprising the steps of:

- (a) dividing an input image into a plurality of local-segments;
- (b) registering a learning image into a learning image database;
- (c) selecting a local-segment from the plurality of local-segments;

(ed) extracting a learning-local-segment from the learning image database which is similar to one of the selected local-segment of the input image from the learning image database;

Application No.:
Amendment Dated:
Reply to Office Action of:

09/676,680
March 8, 2004
December 8, 2003

MAT-8021US

(de) relating the extracted learning-local-segment extracted in the step (e) to the one of the selected local-segmentssegment;

(ef) estimating a position of an object to be identified in the input image from coordinates of the one of the selected local-segmentssegment and coordinates of the related learning-local-segment;

(g) repeating steps (c), (d), (e), and (f) for each local-segment of the plurality of local-segments;

a3
(fh) counting a-pairs formed of one of the local-segments and the related a learning-local-segment having an estimated position for the object substantially equal to from which a first position is estimated to determine a score for the first position; and

(gi) judging that the object to be identified is present at the first position when the determined score is greater than a predetermined number.

12. (Withdrawn) An image recognizing apparatus for detecting a shape of an object from an image, comprising:

an image database into which a shape identifier specifying the shape of the object and a model image, which is a image of the object having the shape, are preliminarily registered;

model generating means for extracting feature data of the shape from the model image;

a shape database for storing the feature of the shape with the shape identifier in a combination;

an image input unit for supplying an input image;

an image cutout unit for cutting out an image segment from the input image;

Application No.:
Amendment Dated:
Reply to Office Action of:

09/676,680
March 8, 2004
December 8, 2003

MAT-8021US

shape classifying means for comparing the image segment with the feature data of the shape to determine whether or not the object of the shape is present in the image segment; and

an output unit for releasing data about the shape of the object determined by said shape classifying means and data about a position of the shape of the object in the input image.

13. (Withdrawn) The image recognizing apparatus according to claim 12, wherein said model generating means is operative to:

A3
extract an average image of the model image of the shape and a variance of each pixel in the model image as the feature data of the shape; and

release a combination of the average image, the variance, and the shape identifier into the shape database.

14. (Withdrawn) An image recognizing apparatus for detecting a shape of an object from an image, comprising:

an image database preliminarily storing a shape identifier specifying the shape of the object and a model image which is an image of the object of the shape;

model generating means for calculating a base vector in a feature space from a pixel value of the model image, for projecting the model image in the feature space as a model image vector, for calculating a feature statistic value of the shape from the model image vector having the shape identifier as a feature shape parameter, and for adding the shape identifier to the feature shape parameter;

a shape database for storing the base vector, the feature shape parameter, and the shape identifier in a combination;

an image input unit for supplying an input image;

an image cutout unit for cutting out an image segment from the input image;

shape classifying means for projecting the image segment in the feature space to determine an image segment vector based on the base vector and for comparing the image segment vector with the model image using the feature shape parameter to determine whether or not the shape of the object is present in the image segment; and

an output unit for releasing data about the shape of the object and data about a position of the shape of the object in the input image when an object of which shape coincides the shape to be detected is present in the input image.

a³

15. (Withdrawn) The image recognizing apparatus according to claim 14, wherein said model generating means is operative to calculate the feature shape parameter from an average vector and a covariance of the model image vector derived from the model image.

16. (Withdrawn) The image recognizing apparatus according to claim 14, wherein said model generating means is operative to calculate an average image of the model image, calculate a base vector from a pixel value of the average image, project the model image in the feature space as a model image vector, and add the shape identifier to the model image vector.

17. (Withdrawn) The image recognizing apparatus according to claim 14, wherein the shape identifier includes data indicating what portion of the object the shape is.

18. (Withdrawn) The image recognizing apparatus according to claim 17, wherein said shape classifying means is operative to estimate an overall area which the object occupies in the input image from the image segment of the shape identifier and sum up the overall area estimated for the image segment to output a position of the overall area of the object.

19. (Withdrawn) An image recognizing method for detecting a shape of an object from an image, comprising the steps of:

Application No.:
Amendment Dated:
Reply to Office Action of:

09/676,680
March 8, 2004
December 8, 2003

MAT-8021US

registering a shape identifier specifying the shape of the object to be identified and an image of the object having the shape as a model image into an image database;

extracting feature data of the shape from the model image;

releasing the feature data of the shape and the shape identifier in a combination into a shape database;

A³
Confidential
supplying an input image to be determined whether or not the object is present therein;

cutting out an image segment from the input image;

comparing the image segment with the feature data of the shape to determine whether or not the object of the shape to be identified is present in the image segment; and

releasing data about the shape of the object and data about a position of the shape of the object in the input image.
